

What is claimed is:

1       1. A method comprising:  
2           computing for a path that includes multiple links a first  
3       color vector that indicates colors that all of the multiple  
4       links include; and

5           computing for the path a second color vector that  
6       indicates colors that none of the multiple links include.

1       2. The method of claim 1 further comprising considering  
2       the path for inclusion in a label switched path (LSP) if the  
3       path includes all colors that must be included in the LSP and  
4       does not include any colors that must be excluded from the  
5       LSP.

1       3. The method of claim 1 further comprising determining  
2       whether the path includes all colors that must be included in  
3       a label switched path (LSP) by performing an AND operation on  
4       the first color vector and a mask indicating colors that must  
5       be included in the LSP and determining if a result of the AND  
6       operation equals the mask.

1       4. The method of claim 1 further comprising determining  
2       whether the path includes any colors that must be excluded  
3       from a label switched path (LSP) by performing an AND  
4       operation on the second color vector and a mask indicating  
5       colors that must be excluded from the LSP and determining if a  
6       result of the AND operation equals zero.

1       5. The method of claim 1 further comprising  
2       automatically re-computing the first color vector and the  
3       second color vector if a characteristic of any of the multiple  
4       links changes.

1       6. The method of claim 1 further comprising  
2 automatically re-computing the first color vector and the  
3 second color vector if one or more of the multiple links  
4 included in the path changes.

1       7. The method of claim 1 wherein the colors indicate  
2 service characteristics of the multiple links.

1       8. The method of claim 1 wherein the path runs through  
2 the Internet.

1       9. A method comprising:  
2           calculating whether a path including multiple links  
3 includes all colors that must be included in a label switched  
4 path (LSP); and  
5           calculating whether the path includes any colors that  
6 must be excluded from the LSP.

1       10. The method of claim 9 further comprising considering  
2 the path for inclusion in the LSP if the path includes all  
3 colors that must be included in the LSP and does not include  
4 any colors that must be excluded from the LSP.

1       11. The method of claim 9 in which the calculating is  
2 performed automatically.

1       12. The method of claim 9 wherein calculating whether  
2 the path includes all colors that must be included in the LSP  
3 includes performing an AND operation on a color vector of the  
4 path that indicates colors that all of the multiple links  
5 include and a mask indicating colors that must be included in  
6 the LSP and determining if a result of the AND operation  
7 equals the mask.

1       13. The method of claim 9 wherein calculating whether  
2 the path includes any colors that must be excluded from the  
3 LSP includes performing an AND operation on a color vector of  
4 the path that indicates colors that any of the multiple links  
5 include and a mask indicating colors that must be excluded  
6 from the LSP and determining if a result of the AND operation  
7 equals zero.

1       14. The method of claim 9 further comprising  
2 automatically determining if the path is eligible for  
3 inclusion in the LSP based on whether the path includes all  
4 colors that must be included in the LSP and whether the path  
5 includes any colors that must be excluded from the LSP.

1       15. The method of claim 9 further comprising  
2 concurrently performing the calculation of whether the path  
3 includes all colors that must be included in the LSP and the  
4 calculation of whether the path includes any colors that must  
5 be excluded from the LSP.

1       16. The method of claim 9 further comprising first  
2 performing the calculation of whether the path includes all  
3 colors that must be included in the LSP or the calculation of  
4 whether the path includes any colors that must be excluded  
5 from the LSP, and

6            performing the other calculation only if the first  
7 calculation determines that the path includes all colors that  
8 must be included in the LSP or excludes all colors that must  
9 be excluded from the LSP.

1       17. The method of claim 9 further comprising setting up  
2 the LSP.

1       18. The method of claim 9 wherein the path includes  
2 stacked LSPs.

1       19. The method of claim 9 wherein the colors indicate  
2 service characteristics of the multiple links.

1       20. The method of claim 9 wherein the calculations are  
2 performed when one or more of the multiple links changes.

1       21. An article comprising a machine-readable medium  
2 which stores machine-executable instructions for computing  
3 resource color for composite links, the instructions causing a  
4 machine to:

5       calculate whether a path including multiple links  
6 includes all colors that must be included in a label switched  
7 path (LSP); and

8       calculate whether the path includes any colors that must  
9 be excluded from the LSP.

1       22. The article of claim 21 further causing a machine to  
2 consider the path for inclusion in the LSP if the path  
3 includes all colors that must be included in the LSP and does  
4 not include any colors that must be excluded from the LSP.

1       23. The article of claim 21 in which the calculating is  
2 performed automatically.

1       24. The article of claim 21 wherein calculating whether  
2 the path includes all colors that must be included in the LSP  
3 includes performing an AND operation on a color vector of the  
4 path that indicates colors that all of the multiple links  
5 include and a mask indicating colors that must be included in  
6 the LSP and determining if a result of the AND operation  
7 equals the mask.

1       25. The article of claim 21 wherein calculating whether  
2 the path includes any colors that must be excluded from the  
3 LSP includes performing an AND operation on a color vector of  
4 the path that indicates all of the colors that any of the  
5 multiple links include and a mask indicating colors that must  
6 be excluded from the LSP and determining if a result of the  
7 AND operation equals zero.

1       26. The article of claim 21 further causing a machine to  
2 automatically determine if the path is eligible for inclusion  
3 in the LSP based on whether the path includes all colors that  
4 must be included in the LSP and whether the path includes any  
5 colors that must be excluded from the LSP.

1       27. The article of claim 21 further causing a machine to  
2 concurrently determine whether the path includes all colors  
3 that must be included in the LSP and determine whether the  
4 path includes any colors that must be excluded from the LSP.

1       28. The article of claim 21 further causing a machine to  
2 first perform the calculation of whether the path includes all  
3 colors that must be included in the LSP or the calculation of  
4 whether the path includes any colors that must be excluded  
5 from the LSP, and

6           perform the other calculation only if the first  
7 calculation determines that the path includes all colors that  
8 must be included in the LSP or excludes all colors that must  
9 be excluded from the LSP.

1       29. The article of claim 21 further causing a machine to  
2 set up the LSP.

1       30. The article of claim 21 wherein the path includes  
2 stacked LSPs.

1       31. The article of claim 21 wherein the colors indicate  
2 service characteristics of the multiple links.

1       32. The article of claim 21 wherein the calculations are  
2 performed when one or more of the multiple links changes.

1       33. An apparatus comprising:

2            a mechanism configured to route data between devices  
3 configured to connect to a network; and

4            a process accessible by the mechanism that is configured  
5 to automatically compute two color vectors for a path running  
6 across the network and including multiple links.

1       34. The apparatus of claim 33 wherein the process is  
2 also configured to perform the automatic computing if one or  
3 more of the multiple links changes.

1       35. The apparatus of claim 33 wherein the mechanism is  
2 also configured to consider the path for inclusion in a label  
3 switched path (LSP) across the network if the path includes  
4 all colors that must be included in the LSP and does not  
5 include any colors that must be excluded from the LSP.

1       36. The apparatus of claim 33 wherein computing one of  
2 the color vectors includes determining whether the path  
3 includes all colors that must be included in a label switched  
4 path.

1       37. The apparatus of claim 36 wherein determining  
2 whether the path includes all colors that must be included in  
3 a label switched path (LSP) includes performing an AND

4 operation on a color vector of the path that indicates colors  
5 that all of the multiple links include and a mask indicating  
6 colors that must be included in the LSP and determining if a  
7 result of the AND operation equals the mask.

1 38. The apparatus of claim 33 wherein computing one of  
2 the color vectors includes determining whether the path  
3 includes any colors that must be excluded from a label  
4 switched path.

1 39. The apparatus of claim 38 wherein determining  
2 whether the path includes any colors that must be excluded  
3 from a label switched path (LSP) includes performing an AND  
4 operation on a color vector of the path that indicates all of  
5 the colors that any of the multiple links include and a mask  
6 indicating colors that must be excluded from the LSP and  
7 determining if a result of the AND operation equals zero.

1 40. The apparatus of claim 33 wherein the process is  
2 also configured to determine if the path is eligible for  
3 inclusion in the LSP based on whether the path includes all  
4 colors that must be included in the LSP and whether the path  
5 includes any colors that must be excluded from the LSP.

1 41. The apparatus of claim 33 wherein the mechanism is  
2 also configured to notify other devices of the computed color  
3 vectors.

1 42. The apparatus of claim 33 wherein the mechanism is  
2 also configured to set up a label switched path across the  
3 network.

1 43. The apparatus of claim 33 wherein the process  
2 includes software to automatically compute the color vectors.